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A series of Preparatory Living Lab workshops as the enabler of a co-creation ecosystem under the IntelComp platform

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Abstract

The phenomena of climate change transcend all national and regional boundaries. Human health, agriculture and food production, forest fires, changes in ocean salinity, and other human and environmental phenomena are only a few examples of how it affects both. To address this complex challenge, we must determine the areas of the country of interest, in this case, Greece, that have been most adversely affected by climate. Greece is surrounded by water, and a significant part of its GDP is derived from the marine and maritime industries, including tourism. These industries are particularly vulnerable to the effects of the climate crisis, from rising sea levels and water acidification to declining fish stocks and biodiversity loss. Since the start of the IntelComp project, a Preparatory Living Lab (PLL) has been planned and delivered, feeding into the development of the IntelComp platform and the Living Lab on Climate Change Adaptation. The PLL led to the identification of the needs and gaps in the four seas (Mediterranean, Black, Caspian, Aral) and the selection of the Energy Sector as the primary focus sector for the Climate Change case study of the IntelComp project.

Key words
Living Lab, Climate Change, IntelComp project, Mediterranean Sea, Black Sea, Caspian Sea, Aral Sea, Energy

Abbreviations

CMA: Common Maritime Agenda
HPC: High Performance Computing
LL: Living Lab
MAP: Mediterranean Action Plan
MSSD: Mediterranean Strategy for Sustainable Development
MSP: Maritime spatial planning
PLL: Preparatory Living Lab
SDGs: Sustainable Development Goals
STI: Science, Technology, and Innovation
UNEP: United Nations Enbvironment Programme

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1. Introduction

Large Science, Technology, and Innovation (STI) datasets are handled in an environment for high performance computing (HPC), which is a replica of the European Open Science Cloud (EOSC). Understanding and analyzing this data is essential for evidence-based policy making since public administration at all organizational and geographic levels, STI stakeholders, and civil society produce a significant amount of dynamic, multilingual, and heterogeneous data (such as national STI strategies, plans, and work programmes, calls, projects, reports, scientific publications, patents, dissemination articles, etc.).

IntelComp project, funded by Horizon 2020, aims at providing a platform with capabilities to support the entire STI policy spectrum, including agenda setting, modeling design, implementation, monitoring, and assessment. By utilizing open data, services, and computational resources from the EOSC, HPC environments, and federated distributed operations at the European Union, national, and regional level, multidisciplinary teams will be brought in to co-develop innovative analytics services, Natural Language Processing pipelines, and Artificial Intelligence workflows.

The project will guarantee a collaborative setting where various players can visualize, interact with, and evaluate data. In order to examine, experiment with, and assess STI policies at all phases, IntelComp will take a living labs approach and involve public policy makers, academia, industry, SMEs, local actors, civil society, and people. The areas that IntelComp will focus on are artificial intelligence, climate change, and health, which are in line with the European Agenda and the Horizon Europe Missions.

The goal of the IntelComp project, a Horizon 2020 Innovation Action, is to create a platform that can analyze vast amounts of textual data utilizing services provided by artificial intelligence. To validate the resulting platform, IntelComp uses a Living Labs (LLs) methodology and involves external stakeholders (public administrations, civil society organizations, academic institutions, and industry organizations) in the co-creation of Science, Technology, and Innovation (STI) policies in the areas of artificial intelligence, climate change, and cancer.

The three LL that IntelComp plans to implement—AI, Cancer, and Climate Change—are very diverse from one another and extremely pertinent to our day. A real-world environment and a co-involvement approach are the two key components of the ATHENA RC-led Living Labs on Climate Change.

Climate Change is a phenomenon that knows no national or regional limits. Its effects can be seen in both the natural and human spectra such as, human health, agriculture and food, forest fires, alterations in ocean salinity etc. The rising population and disposable income together with the fast and linear consumption model led to skyrocketing the Greenhouse Gas (GHG) emissions in the last century and to a climate crisis which is accompanied by significant biodiversity losses, extreme weather events and more and more frequent catastrophes all around the world.

The rapid decarbonization challenge together with the broad range of data needed puts an unrealistic demand to policy makers and STI analysts to respond to this great challenge. IntelComp platform aims to simplify this burden by developing three tools, namely:

- The STI Viewer, that will analyze, compare and visualize a comprehensive set of STI related KPIs
- The STI Policy Participation Portal, that will provide a synthetic list of measurements for participatory STI policy making
- The Evaluation Workbench, that will assist in the ex-ante evaluation of STI proposals for funding.

To address this complex challenge, we need to identify the areas most impacted by climate change in the country of interest, in this case, Greece. Greece is surrounded by sea with most of its GDP being dependent on the marine and maritime sector (including tourism), which are sensitive to the climate crisis, from rising sea levels and water acidification to decreasing fishing stocks and biodiversity loss. These effects have a direct impact on the human though 5 interconnected domains, namely, water resources, ecosystems, food safety and security, health, and human security, which have an impact on the tourism and the agriculture sectors of Greece. Thus, adaptation to climate change in Greece cannot be addressed without approaching the challenges in the Mediterranean Sea and its neighbour and connected seas, the Black, Caspian and Aral, which see no boundaries. In addition, National policies are affected both by the international regulatory framework and by global trends and events.

2. Sustainability challenges in the Mediterranean, Black, Caspian and Aral Sea

2.1. The Mediterranean Sea

The Mediterranean Sea warms faster than other ocean regions due to its geographical position between the semiarid and arid climate of North Africa and the temperate climate of Central Europe, leading to a climate particularly vulnerable to minor general circulation modifications. Its position (semi-enclosed) allows the Mediterranean to store heat, as the hydrological exchange with the open ocean is small. Thus, endemic marine biota are extremely vulnerable to alterations to their environment, while they have to cope with the arrival and adaptation of alien species through the Suez Canal.

The fragility of the Mediterranean Sea is further affected by climate change on multiple levels, such as water distribution, salt-water intrusion, drier lands with higher risk for forest fires and even food production. Extreme events bring losses to crops, while ocean warming

and acidification directly impact fisheries and aquaculture. Appart from that, climate change eases the transmission of vector-, water-, and food-borne diseases in the area, while human insecurity is increased due to droughts, water scarcity, food redundancy and economic instability.

The Mediterranean Sea, including the Sea of Marmara, occupies an area of approximately 2,510,000 km^2. The Mediterranean region consists of 21 littoral states (Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria (data availability limited to 2007), Tunisia, and Turkey) with a combined population of 529 million, or 7% of the world's population, 205 million of which live on the northern shore and 324 on the southern and eastern shore, see Figure 1, (Salah & Boxer, 2022; United Nations, 2022).

Figure 1 - The Aral Sea Basin. Map compiled from: Geographic Guide (http://www.geographicguide.com/europe-maps/mediterranean.htm)

Given that it is one of the most highly valued seas in the world, the Mediterranean has a variety of significance for the global economy. However, political upheavals and conflicts have frequently impeded the region's progress toward economic integration and growth. The significant north-south component that affects all intra-regional flows, as well as the marked variety of the nations' performance in international commerce, investment flows, and energy (oil and gas) potential, are the two prominent characteristics of the Mediterranean's regional economic links. These traits suggest that, despite a lack of regional integration, there are chances to improve intra-regional ties as the Mediterranean region integrates more fully into the global economy and reaps the benefits of long-standing multilateral and cooperative frameworks in the region (Manoli P., 2021).

A complicated security environment, institutional and political variability, uneven economic development, income disparities, and a high degree of variety among the region's coastline nations characterize the region today. Most of the discrepancies can be categorized as a north-south divide, where the northern coasts of the sea have developed, stable societies that have integrated into the EU, while the southern shores have unstable socioeconomic indices.

The Mediterranean Sea, a significant contributor to the regional GDP, today generates enormous economic value through its natural ecosystems and maritime resources. Important maritime-based industries include energy, bioprospecting, deep-sea mining, tourism, fisheries, and aquaculture. Ocean-related industries in the Mediterranean region alone generated US$450 billion in 2017, accounting for 20% of the global yearly gross marine product (GMP) in a region that makes up just 1% of the ocean overall. The Mediterranean GMP's largest contributor was Italy, which was followed by Spain, France, and Turkey (Randone, 2017).

It is safe to conclude that tourism continues to be the main driver of economic growth in the Mediterranean, with 92% of the region's GMP coming from coastal tourism, which is valued at roughly US$300 billion annually, and marine tourist, which is valued at about US$110 billion yearly. The WTTC (2017) estimates that 16% of the population of the Mediterranean was employed in the tourism industry in 2016 either directly — by hotels, travel agencies, transportation services, food, and leisure industries directly supported by tourists — or indirectly — by travel & tourism investment spending, government spending, and supplier purchases. After tourism and transportation, fisheries, including aquaculture, are the third most valuable socio economic sector in the Mediterranean. The Mediterranean has long been a dynamic economic region that allows for the transportation of goods, energy, and people because of its advantageous location (Petrick et al., 2017)

Due to the fact that trade movements within the region account for 25% of all international seaborne trade, the region is significant for global trade. The Mediterranean's shores are home to about 600 ports of various sizes (Plan Blue, 2015). Over the past two decades, the transportation of products has experienced tremendous growth, and the International Transport Outlook 2019 predicts that between 2015 and 2050, the demand for global freight will quadruple, with ships carrying 75% of the freight (ITF, 2019). Overall, the maritime transport and trade sector supports 550,000 local jobs and contributes 20% to 40% of the GDP in the majority of Mediterranean nations (MGI, 2017).

The Mediterranean is the most significant sea region for the EU in terms of short sea shipping (of goods), accounting for 31% of the total EU short sea shipping tonnage for all sea regions in 2018 (followed by the North Sea and the Baltic, which accounted for 23% and 21% of the total EU short shipping tonnages, respectively) (Docks the Future, 2020). The Belt and Road Initiative (BRI), which is being driven by China and is largely a major infrastructure project meant to assist Chinese exports to European markets, now includes the Mediterranean. BRI maritime lines include ports in southern Mediterranean nations, such as Egypt's canal ports, as well as ports on the northern Mediterranean coast (Piraeus in Greece) (Ismailia and Port Said). The BRI also includes Chinese cooperation agreements in other fields like agriculture, renewable energy, water, chemicals, and ports in the Mediterranean (as in the case of Israel).

The Sustainable Development Goals (SDGs) and the Agenda 2030 for Sustainable Development are translated at the regional, sub-regional, national, and local levels in the Mediterranean region through the Mediterranean Strategy for Sustainable Development (MSSD) for the period 2016–2025, which offers an integrative policy framework for all stakeholders, including the Mediterranean Action Plan of the United Nations Environment Programme (UNEP/MAP) partners (UNEP/MAP, 2016, 2022). As the first regional action plan formed under the UNEP Regional Seas Programme, the UNEP/MAP is a regional cooperation platform. UNEP/MAP was instrumental in the negotiation and adoption of the Convention for the Protection of the Marine Environment and Coastal Region of the Mediterranean (COP 21: Barcelona Convention) and its Protocols by the Contracting Partners (21 Mediterranean countries and the European Union[1]).

The MSSD, adopted by all Mediterranean countries at the 19th Meeting of the Contracting Parties to the Barcelona Convention (COP 19) in 2016 in Athens (Greece), acts as a strategic document that aims to adapt international commitments to regional conditions and to guide national strategies and stimulate regional cooperation in the achievement of sustainable development objectives. The vision of the MSSD is "*A prosperous and peaceful Mediterranean region in which people enjoy a high quality of life and where sustainable development takes place within the carrying capacity of healthy ecosystems. This is achieved through common objectives, strong involvement of all stakeholders, cooperation, solidarity, equity and participatory governance".*

2.2. The Black Sea

The Black Sea is a meromictic basin with anoxic conditions below 200m. As a result, the upper thin layer (0-200m) supports biological life due to the high hydrogen sulfide concentration in the deeper (and denser) water layers. A warming trend is observed in the middle layer of the Black Sea that may alter the stratification of waters. As a result, sulfide, noxious and corrosive chemicals from the bottom will be freed to the upper surface layer harming the Sea's biota. Moreover, water quality, larvae and pollutant dispersal will be affected as the wind stress curl over its basin is expected to be reduced.

The Black Sea covers 436,400 km^2 (not including the Sea of Azov), has a maximum of 2,212 m depth and 547,000 km^3 volume (Europa – Gateway of the European Union website, 2022; Murray et al., 1989; UDEL, 2022). Romania, Ukraine, Russian Federation, Georgia, Turkey, and Bulgaria are the nations that border the Black Sea. There are around 17.5 million permanent residents in the Black Sea regions, while 6–8 million visitors visit each year (Vespremeanu & Golumbeanu, 2018).

[1] The 22 Contracting Parties to the Barcelona Convention are: Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syrian Arab Republic, Tunisia, Türkiye, and the European Union.

Figure 2 - The Aral Sea Basin. Map compiled from Britannica (source: https://www.britannica.com/place/Black-Sea)

A total of 63 harbours have been recorded in the Black Sea catchment region, with the following numbers: Romania: 18 harbours (including rivers), Ukraine: 18, Bulgaria: 2, Moldova: 1, Turkey: 24 (Black and Marmara Sea) (Golumbeanu and Nicolaev in Study on integrated coastal zone management. Ex Ponto Publishing House Constanta, 2015). The major ports along the Black Sea coast are Samsun and Istanbul (Turkey), Samsun and Sulina (Romania), Odessa, Mariupol (Ukraine), Tuapse, Poti and Batumi (Georgia), Burgas and Varna (Bulgaria).

As a follow-up to the commitment of the 2018 Burgas Ministerial Declaration, the seven participating Countries[2] set and approved the **Common Maritime Agenda (CMA) for the Black Sea** on May 21, 2019. To attain Healthy marine and coastal ecosystems is the CMA's first goal. According to this objective, the Black Sea and its marine and coastal ecosystems are in danger. The effects of climate change, such as sea level rise, erosion, ecological changes, acidification, natural meteorological effects, and temperature increases, are partially to blame for this.

The marine and coastal environment is directly impacted by unsustainable past, present, and future maritime, coastal, and terrestrial activities such as pollution, marine litter, wastewater, and unsustainable practices. The biggest obstacle is ensuring environmental sustainability and protection while using coastal and marine resources all along the Black Sea. The environmental conservation of the shared natural heritage must be improved through regional voluntary collaboration and teamwork to accomplish this.

[2] Republic of Bulgaria, Georgia, Republic of Moldova, Romania, the Russian Federation, the Republic of Turkey, Ukraine

The goals and priorities of CMA are the following:

Goal 1: Healthy marine and coastal ecosystems
- Priority 1: Ensure the protection and sustainability of the marine ecosystem
- Priority 2: Address marine pollution and plastic litter
- Priority 3: Support sustainable fisheries and aquaculture in the Black Sea
- Priority 4: Supporting innovative marine research infrastructures in the Black Sea
- Priority 5: Encourage the production, management and sharing of marine and coastal environmental knowledge for effective environmental monitoring and observation

Goal 2: A competitive, innovative and sustainable blue economy for the Black Sea
- Priority 1: Foster innovative business models, stimulate research and innovation, and sustainable growth and up-to-date jobs
- Priority 2: Promote transport and digital connectivity of the Black Sea
- Priority 3: Promote blue skills and blue careers as an engine for innovation and competitiveness

Goal 3: Fostering Investment in the Black Sea blue economy
- Priority 1: Improve access to financial resources and promote sustainable investment in the blue economy
- Priority 2. Promote maritime entrepreneurship and clusters

In the Black Sea region, maritime policy-making has not yet fully absorbed the notion of maritime spatial planning. In compliance with the EU Directive for Maritime Spatial Planning (MSP), Bulgaria and Romania must present their national maritime spatial plans by March 2021. The ICZM Project "Black Sea CBC - Joint Operational Programme" began the first inventory of Black Sea MSP in 2013 with regards to national policies for marine space, data collecting and information exchange, cooperation with Member States, and cooperation with third nations (European Commission, 2022).

2.3. The Caspian Sea

The Caspian Sea is a closed endorheic basin that does not have an outflow, meaning that its water levels are determined by balancing precipitation, run-off input and evaporation. Global warming will lead to a freshwater imbalance that over 50 years results in a 5.0 m drop in sea level, retrieval of the shoreline and impacting the ecosystem. Some research shows that the water level drop ranges from 9.0 m to 18.0 m. Any drop in the sea level, smaller or bigger, will lead to severe stress on biodiversity and the economy. For instance, shallow-water habitats will disappear, depriving a major food source for fish, migrating birds and the endangered Caspian Seal, as well as spawning grounds for endemic and endangered species. Furthermore, shipping outside of the Sea will be affected by the water level drop.

The Caspian Sea, the largest inland body of water in the world, is located on the boundary between Europe and Asia. Without outflow, the sea itself has a surface area of 378,400 km2 and a volume of 78,200 BCM, or almost 40% of the world's surface water. The Russian

Federation, Azerbaijan, Iran, Kazakhstan, and Turkmenistan all border its coast. Its total catchment area is around 3.1 million km2, and it includes portions of Georgia and Armenia in addition to the five riparian nations. Approximately 70–80 million people reside within the Caspian Sea watershed as a whole, with 50–60 million of them residing in Russia (The World Bank Group, 2004b).

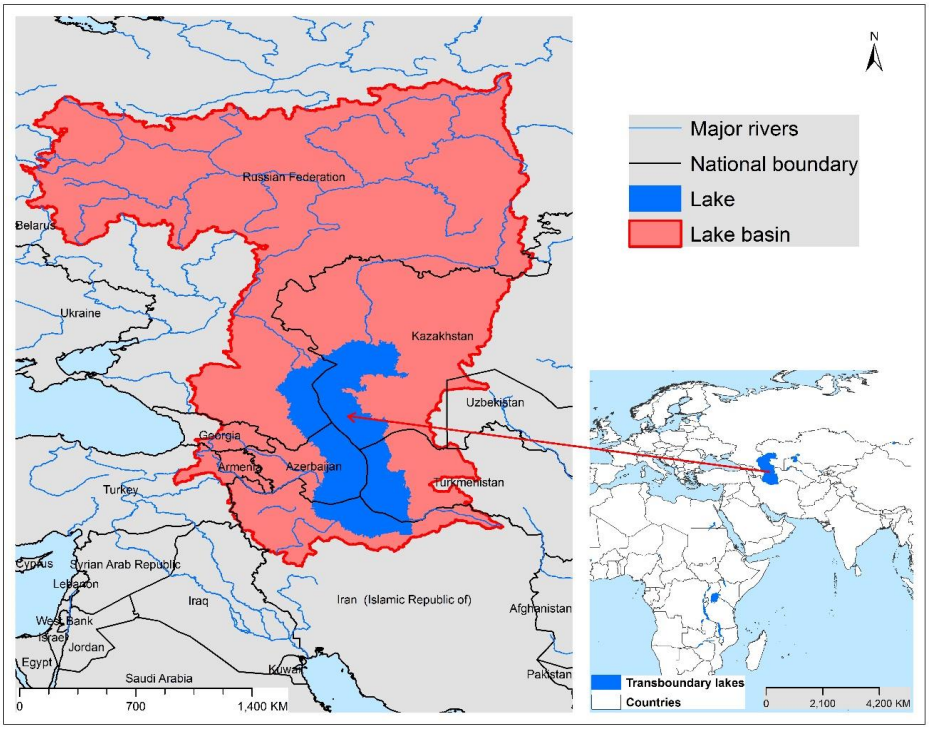

Figure 3 - The Caspian Sea Basin. Map compiled from ILEC TWAP Lakes Portal (source: http://ilec.lakes-sys.com/portals/lake_detail/28)

To address the issues of regulation and prevention of the environmental degradation of the Caspian Sea and for its sustainable development, as well as to ensure the well-being of the population, the Caspian Environment Program (CEP) was established in 1998 as a regional umbrella program. Within the framework of the CEP, Strategic and National action plans and various transnational measures are being developed, as well as major regional projects in the field of sustainable use of bioresources, improved coastal zone management, monitoring of seawater quality with the assistance of the GEF, UNDP, EU (UNEP, 2022).

One of the critical strategic documents was the Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Tehran Convention), signed and supported by all five Caspian countries: Kazakhstan, Azerbaijan, Iran, Russian Federation and Turkmenistan. The Tehran Convention, which entered into force on August 12, 2006, serves as a framework legal instrument establishing general obligations and institutional arrangements (CEIC, 2022b). This Convention is the first legal agreement between 5 countries and has become a big step towards implementing the sustainable use of the resources of the Caspian Sea. Four protocols of the Convention have been adopted and signed: Protocol Concerning Regional Preparedness, Response and Cooperation in Combating Oil Pollution Incidents ("Aktau Protocol"); Protocol on the Protection of the Caspian Sea against Pollution from Land-based Sources and Activities ("Moscow Protocol"); Protocol for the Conservation of Biological Diversity ("Ashgabat Protocol"); Protocol on

Environment Impact Assessment in a Transboundary Context, and negotiations are underway on the 5th Protocol by now (CEIC, 2022a). The 5th Protocol on Monitoring, Assessment and Information Exchange will greatly facilitate studying the Caspian Sea's environmental state through the adoption of a unified monitoring methodology.

2.4. The Aral Sea

Due to regional and local climate change, the countries in the Aral Sea basin that are located in the arid zone are most vulnerable to high hazards and dangers. The temperature is warming over Central Asia, and long-term projections based on climate scenarios show no increase in the region's water resources. Additionally, as water quality, particularly groundwater, deteriorates, countries in the intermediate and lower reaches of transboundary rivers will see a reduction in available water resources and an increase in water scarcity. The population's ability to acquire high-quality drinking water will be the main concern. Rapid desertification, decreasing snow cover, salinization of the land, loss of biodiversity, and increased deforestation are all projected to have a substantial impact on the hydrographic regime of surface waterways.

The region's political, food, energy, sanitary, and environmental security will be significantly and permanently impacted by the cumulative negative consequences of climate change, which will increase competition for water among the countries in the region. The frequency of natural emergencies is expected to increase along with the frequency of hazardous and extreme hydrometeorological occurrences, such as hail, drought, excessively high or low temperatures, etc. Heavy downpours, mudflows, landslides, avalanches, floods, and droughts are a few of them. The current ecosystems and biodiversity may also be threatened by climate change (Narbayep & Pavlova, 2022).

The 1.9 million square kilometres (km^2) Aral Sea basin is located in Central Asia and is mostly shared by six countries: Kazakhstan, Turkmenistan, Uzbekistan, Afghanistan, Tajikistan and the Kyrgyz Republic (Figure 4). Kazakhstan and the independent Republic of Karakalpakstan in Uzbekistan are on opposite sides of the Aral Sea. The Aral Sea is populated by approximately 35 million people, two-thirds of the combined population of these countries (The World Bank Group, 2004a).

Figure 4 - The Aral Sea Basin. Map compiled from (Gaybullaev et al., 2012; Micklin, 2007)*; Landsat satellite imagery from USGS/NASA; Digital Elevation Model from USGS EROS; visualization by UNEP/GRID-Sioux Falls.*

In 1993, the Republics of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan signed an agreement on joint activities related to the Aral Sea. Among others, this agreement seeks to foster, to the maximum extent, scientific research, projects and activities aiming at maintaining the necessary water quality in the rivers, reservoirs, and springs, restoring the balance of the region's devastating ecosystems, assuring the water inflows required to preserve the decreased but stable Aral Sea, and taking action to protect migratory species (International Water Law Project, 1993). The International Fund for Saving the Aral Sea (IFAS) was created based on this agreement.

However, IFAS has shown itself to be inefficient in attracting investments and implementing regional programs. Since the formation of the Fund, new regional problems have arisen related to managing water and energy resources, climate change, and increasing the shortage of water resources. The main reason is that the statutory and other regulatory documents of the Fund do not reflect the interests of all participating countries and their approaches to the solution. And later, in 2016, Kyrgyzstan froze participation in IFAS and its bodies (Azattyk, 2016). Another problem is that the activities of IFAS were primarily supported by funding from Kazakhstan and Uzbekistan. Therefore, in November 2018, Uzbekistan launched the Multi-Partner Human Security Trust Fund for the Aral Sea region in Uzbekistan with the support of the UN (MPHSTF, 2021). The Uzbek-Kazakh joint working group on environmental protection and water quality issues in the Syrdarya River basin proved to be the most successful in its work. The working group conducts joint monitoring and exchange of data on the ecological state of the Aral Sea (Kazhydromet, 2021). Today, the countries of Central Asia agree that it is necessary to reform the IFAS by improving the organizational and legal framework of the Fund.

3. A series of Preparatory Living Lab workshops as a co-creation tool for the development of the IntelComp platform

To address the above-mentioned challenges, a Preparatory Living Lab (PLL) comprised of seven workshops has been designed and delivered from the beginning of the IntelComp project. The PLL is part of the IntelComp Living Lab on Adaptation to Climate Change. The ultimate goal of the Living Lab on the adaptation to climate change is to support the invention and development process of the IntelComp platform, which is divided into the following five parts:

1. Contextual research, in which participants look at the surroundings and the areas of focus (participatory living labs)
2. Discovery, where users are asked to share their knowledge about unforeseen STI policy-based activities and novel service options made available by the IntelComp platform.
3. Co-creation, in which the IntelComp platform's users participate as co-creators
4. Evaluation, in which customers assess and confirm brand-new products and services offered by the IntelComp platform.
5. Technical testing, which involves giving consumers technical

In the first phase of the project (June 2021 (Month 6) – February 2022 (Month 14), a total of seven workshops were delivered, comprised of participants coming from the Mediterranean, Black, Caspian and Aral Seas aiming to discuss the dominant challenges in the four seas, unfold the STI indicators and KPIs that can bring value to their day to day business and support the data collection process of the technical team by providing guidance regarding the data sources available in their countries as well as the gaps in these data pools. Finally, these discussions aspire to reveal the sector with the highest impact on climate change adaptation and mitigation, which will be the starting point of the second phase of the Living Lab. This phase is expected to initiate when the first tool of IntelComp platform, the STI Viewer, is at the pilot stage - around December 2022 (Month 24) - and thus, stakeholders will be able to comprehend the potential and capabilities of the platform and provide constructive feedback on the missing areas.

The selected stakeholders of the PLL came from research, education, innovation, civil society, private sector and public/regulatory authorities. To increase the outreach and the results of the PLL, a collaboration with the UN SDSN SEAs Initiative was pursued (SDSN Europe, 2022). The UN SDSN Sustainable Euro-Asian Seas (SEAs) Initiative was created to hasten Science Driven Sustainable Blue Growth and the implementation of the United Nations Sustainable Development Goals (Agenda 2030) in the Euro-Asian Seas and beyond. The SEAs initiative helped the delivery of the PLL of the IntelComp project by connecting it with the appropriate parties as well as by supporting and publicizing its operations.

The remaining workshops, with the exception of the first, were split into two groups, one focusing on issues in the Mediterranean Sea and the other on issues in the Black, Caspian,

and Aral Seas. Stakeholders were asked to explain themselves and the job they do during the first session after learning about the problem of climate change, its effects on the oceans, and the project's goals and objectives. The participants in the second and third sessions attempted to solve the mystery surrounding data mining. They first gave feedback on the availability and frequency of the global datasets that are most frequently used in research projects, including the OECD database, World Bank, relevant UN Stats sites, Eurostat, SDSN Index & Monitoring, and European Policies sites, where one can find all of the EU policies organized by topic. The next step involved splitting the participants into two breakout rooms with the goal of addressing the following issues: What data platforms or monitoring tools exist in their country; how do they stay informed; and what is missing.

This discussion led to the definition of the and the establishment of a common ground for further analysis. In our circumstance, the majority of participants appeared to comprehend the seriousness and complexity of the data identification difficulty and to concur with the majority of the various points and specifics brought up during the workshop. The participants reported a number of issues with the suggested data sources, including a lack of common file structures, a lack of daily and open data, a lack of data validation, a lack of accessible and reliable data, a lack of geospatial data, a lack of data on port facilities, and a lack of people with the specialized knowledge needed to collect and analyze relevant data. The participants coming from both the Mediterranean region and the Black Sea/Caspian Sea region showed great interest in the energy sector and expressed their thoughts on what should be examined during energy investments, what concerns them most in the progress towards RES and energy mix. Thus, the energy sector was identified as the dominant area of interest and potential exploitation for adaptation and mitigation of climate change, since off-shore investments, new technologies and wind power intrigued the participants The development of new technologies, as well as the influence of the seas, the infrastructure development and how the optimal mix should alter in regards to climate change, will generate a lot of interest in the future.

The energy sector, which includes the supply of electricity, gas, steam, and air conditioning, was the focus of the fourth and fifth PLLs. The attendees had the chance to discuss their ideas on LNG, hydrogen, methanol, ammonia, and nuclear energy as well as the analytics they should consult before investing in various energy sources, including renewables (solar, wind, geothermal, and hydropower). In the sixth and seventh workshops, we concentrated on the industrial side of the energy sector, talking about topics like how to incorporate innovation into daily business operations, where to look for new research, how to stay informed about evolving regulatory frameworks, and whether or not companies have participated in EU-funded projects.

The PLL's delivery helped participants find a number of materials and information that they would not have been able to locate on their own and helped them comprehend the various approaches that other nations take to combating climate change. Energy was identified as the topic of most interest in the region as a result of the work done in the PLLs. The Living Lab on Adaptation to Climate Change aims to demonstrate the Greek STI - Climate Change ecosystem, starting with the Energy sector, to enhance decision-making. As a result, they focus on five areas: science, industry, policy, environment, and society in an effort to educate and inform decision-makers about the impacts of the energy sector on climate change.

In short, the LLs will seek to increase participant interest in the IntelComp platform, ensure that they use it, and ensure that they are aware of the role that the energy sector plays in combating climate change as well as any rules that may be relevant to that sector. Additionally, they offer technological assessments and foresights, identify future technologies and advances and how they affect policymaking, and examine the national plans as a foundation for policy decisions to ensure that the general public is better informed, alert, and receptive (especially in terms of Initiatives related to climate change technologies).

4. Discussion

When it comes to climate change, there are no geographical borders. Therefore, it is necessary for stakeholders from various geographic areas to discuss and identify shared concerns. The Preparatory Living Lab, part of the Living Lab on Adaptation to Climate Change, brought together people from different scientific backgrounds, working in the public and private sectors, in academia and in NGOs, in regulatory authorities and in private companies, to discuss already set topics and share their main sources of information, as the climate change itself is a major issue that needs to be addressed interdisciplinary and affects every human activity. The insightful information they provided was assessed and used appropriately to get to the future LL on Adaptation to Climate Change primary focal challenge and initiate the development of the IntelComp platform.

The Energy sector was identified as the initial development area of the IntelComp platform considering the new energy solutions that can be provided using the ocean, such the Offshore wind energy, the infrastructure and policy framework which needs to be designed carefully given the dependency on the climate change effects on the seas, described above. The European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy is strengthened by several EU and National policy frameworks, including the European Green Deal, the Climate Law, the National Long-term Strategy for 2050 (on the Climate and Energy) etc. As communicated in the European Commission (2018) the road to a net-zero greenhouse gas economy includes energy efficiency maximization and the deployment of renewables and the use of electricity, which are further described in the National Long-term Strategy for 2050 (Ministry of the Environment and Energy, 2020). Given that both the energy and climate crises the world is currently experiencing are anticipated to influence future policies, the Technical Annex of the EU Taxonomy Report expands the Energy sector into 25 sectors (European Commission, 2020).These sectors are described below:

Electricity, gas, steam and air conditioning supply

1. Production of Electricity from Solar PV
2. Production of Electricity from Concentrated Solar Power
3. Production of Electricity from Wind Power
4. Production of Electricity from Ocean Energy
5. Production of Electricity from Hydropower
6. Production of Electricity from Geothermal

7. Production of Electricity from Gas (not exclusive to natural gas)
8. Production of Electricity from Bioenergy (Biomass, Biogas and Biofuels)
9. Transmission and Distribution of Electricity
10. Storage of Electricity
11. Storage of Thermal Energy
12. Storage of Hydrogen
13. Manufacture of Biomass, Biogas or Biofuels
14. Retrofit of Gas Transmission and Distribution Networks
15. Production of Heat/Cool using Waste Heat
16. District Heating/Cooling Distribution
17. Installation and operation of Electric Heat Pumps
18. Cogeneration of Heat/Cool and Power from Concentrated Solar Power
19. Cogeneration of Heat/Cool and Power from Geothermal Energy
20. Cogeneration of Heat/Cool and Power from Gas (not exclusive to natural gas)
21. Cogeneration of Heat/Cool and Power from Bioenergy (Biomass, Biogas, Biofuels)
22. Production of Heat/Cool from Concentrated Solar Power
23. Production of Heat/Cool from Geothermal
24. Production of Heat/Cool from Gas Combustion
25. Production of Heat/Cool from Bioenergy (Biomass, Biogas and Biofuels)

Consequently, the IntelComp project will aid in policy making by offering relevant tools that will provide insights and analysis in the field of STI (Science, Technology, Innovation) covering all Energy areas presented above. The demands of the stakeholders will be determined through the Living Lab on Climate Change Adaptation, and regional, municipal, and urban initiatives concentrating on energy, laws, policies, and significant climate change-related challenges will be acknowledged. The participants' desire to join the Platform will grow as a result of this co-creation process, and they will use it actively once the tools are officially released in the future.

5. Conclusion

The Preparatory Living Lab, supported by the SEAs Initiative, led to the recognition of the main focus sector of the Climate Change case study, meaning the Energy Sector, as well as the identification of the policy question that the IntelComp project will start with. The following workshops will build on the Energy sector's involvement of stakeholders, primarily from Greece, and inform those who took part in the project's initial phase and are directly impacted by climate change in their local seas.

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